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Southern Pine Beetle Fact Sheet
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USE OF COMPUTER SIMULATION MODELS TO PREDICT EXPECTED TREE MORTALITY AND MONETARY LOSS FROM SPB SPOTS —A RESEARCH UPDATE

Biological systems are exceptionally complex and involve the interaction of many factors. For instance, the establishment and growth of southern pine beetle (SPB) infestations or spots in a pine stand are affected by: temperature, rainfall, SPB population density, the presence of natural enemies, the host's resistance to attack, the suitability of host tissues for brood development, and stand characteristics such as tree density and species composition.

It is necessary to have a basic understanding of interactions between insect, host and environmental variables to predict tree mortality trends or recommend management strategies.

Computer Simulation Models

Computer simulation models have been developed to combine available data with advanced technology and provide predictive systems for use by forest managers. A computer simulation model is a mathematical representation of a biological system. Once developed, simulation models use supplied information to predict an event over time. As additional information is acquired, interpreted, and incorporated into the model, researchers expand their understanding of the overall system. The process of uniting the various elements of the system into one comprehensive model helps identify knowledge gaps and areas in need of additional research.

In the case of spot growth models, modifying the impact of individual components of the system may alter spot growth predictions and thus reflect the natural variation in spot growth under different insect and environmental conditions. The results may be useful in modifying preventative and control tactics. The model provides a cost-efficient way to test control strategies, such as silvicultural treatments or spot growth disruption techniques (using attractants) in various stands at different times of the year (Coulson et al. 1979). Most users would probably employ the model to predict the spread of current SPB spots in their timber stands (Stephen and Coulson 1980). They would use such predictions as an aid when choosing management options and establishing control priorities.

The Arkansas Model

A computer simulation model has been developed at the University of Arkansas to provide forest managers with an accurate predictive system for southern pine beetle spot growth. The system is easy, fast, and inexpensive to use. The model produces short term (2 to 3-month) predictions of expected tree mortality and corresponding monetary loss in currently infested loblolly and/or shortleaf pine stands.

Users do not have to be familiar with computers to run the model and predict infestation growth. A User's Guide informs the user how to sign on to the computing system. Once signed on to the "user-friendly" model, the user needs only to respond to questions supplied by the simulation model.

The following information is needed to make a prediction: spot identification (for user's reference), the State in which the infestation is located, the date the spot was ground checked, the desired number of days of prediction, the percentage of shortleaf and loblolly pines in the stand, the average pine and hardwood basal areas, the average radial tree growth over the last five years, the average age and d.b.h. for the stand, the general d.b.h. distribution of the stand, and the hazard classification of the stand (Belanger 1980).

Predictions can be made with less information, but results are more accurate when all of the preceding information is supplied. In addition, the user must indicate the number of trees currently infested by SPB and the number of trees from which SPB have already emerged, as well as SPB population abundance in the area. If the predominant SPB life stages (i.e. attacking adult, egg, larva, pupa, brood adult) are present at breast height in the infested trees, this information can also be supplied. If an estimate of monetary loss is requested, current prices for salvaged pine sawtimber and pulpwood must also be provided to the model.

The model will predict tree mortality and monetary loss within minutes. Users may then change the current infestation data if they choose to experiment with the effects of changes on the prediction, enter a new set of data for another infestation, or sign off the system.

The model has been shown to produce accurate predictions of spot growth in Arkansas stands. It is currently being evaluated against data from infestations located elsewhere in the South, and modifications are being made to make it adaptable to the diversity of site and stand factors found in southern forests.

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